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An analysis of empirical cases of community wind in Oregon

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ABSTRACT

Recently, a new type of ownership has emerged in the wind energy sector in the U.S. that is referred to as community wind. With the fact that there is little literature on empirical experience of such smaller community based projects, this paper attempts to present seven community wind cases in Oregon to identify opportunities and barriers and so to provide practical information to those who are interested in developing community wind.

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1. Introduction

Global concerns with climate change, energy security, and public health have substantially driven the boom of wind industry over the past few years. But until recently, the U.S. had not witnessed a unconventional structure of wind farms referred to as community wind, which on the other hand has been around in Denmark, Germany, the Netherlands, and the United Kingdom, and many other European countries for a long time [1]. Due to the young age of the ownership structure, little empirical research has been conducted on community wind, not to mention such projects specifically in Oregon. Therefore, this chapter attempts to present Oregon's experience by showcasing seven projects and discussing opportunities and barriers that community wind faces.

Unlike traditional absentee-owned large wind farms, community wind typically is characterized by local ownership and a small size. It often "consists of relatively small utility-scale wind power projects that sell power on the wholesale market and that are developed and owned primarily by local investors" ([2]: 1). We use this definition for the purpose of this chapter, and make sure all the cases selected fit with the definition. It is necessary to point out that by local investors, we mean investors from within Oregon. There is no doubt it will be economically better for a project to be owned by members from the same town, city, or county, because profits will stay in the same town, city, or county. However, we do not discriminate against projects that are owned by members from a different location within Oregon. For example, one case in this chapter is about a project located in Lake County but owned by a company based in Portland since the profits will still stay in Oregon, we consider it as owned by local investors.

2. Methodology

In December 2010, the author conducted 12 ethnographic interviews with project developers, project owners, and governmental officials in Oregon for seven empirical case studies discussed next. The case studies were intended to identify opportunities and barriers for community wind energy development. The seven projects include PáTu Wind Farm and Sayrs Wind Farm in Sherman County, Middle Mountain Project in Hood River County, Mid-Columbia Council of Government's Project in Gilliam County, Big Valley Wind Project in Lake County, Lime Wind in Baker County, and Butter Creek Power in Umatilla County, and they were suggested by personnel at Oregon Department of Agriculture, Oregon Department of Energy, as well as the Community Renewable Energy Association. The interviews followed a semi-structured technique and were recorded using a voice recorder. The author next transcribed all the interviews from the voice recorder to texts.

This paper utilizes the Actor-Network Theory (ANT) to analyze all the interview results. The theory is a qualitative social approach that emphasizes surrounding factors, both human and non-human, involved in the interaction between technology and society. According to the ANT, every factor has different interests and constantly seeks to persuade others to agree with his or her own interests so as to form an alignment with him. As the persuasive process takes place, the relationship between actors is created, and an actor-network is produced, which captures the 'technicalities' and the 'socialities' in the local context [14,27].

Traditionally, the ANT was applied only to situations involving technological innovation, but recently the theory has been successfully applied to the field of technological deployment, such as wind energy [16]. For example, a study on a wind farm project in southern France used the ANT to look at the material aspects of the technology, the characteristics of the construction site, the public participation process, as well as the social dynamics around the project to examine the non-human and human factors that can determine success or failure of the project [14]. The authors explained why the ANT worked very well for wind energy analysis:

> Setting up a wind turbine is a hybrid engineering problem as it touches on the technology of the wind turbines, the geo-physics of various possible locations, the geo-chemistry of climate change, the technology of wind turbines, the economics of wind farming, but also human engineering in the form of the legal intricacies of permitting processes, as well as the psychologies and sociologies of the people involved in the project management, and the acceptance of local actors. ([14]: 6748)

Similar to these previous studies, this paper attempts to apply the ANT to identify major factors which significantly influence the outcome of each case, and the relationships between the major factors.

3. Results

3.1. Case one: PáTu Wind Farm, LLC

3.1.1. Project description

By December 1, 2010, the PáTu Wind Farm was up and running on Hilderbrand family's farmland in Wasco, Sherman County, Oregon. Brothers Ormand Hilderbrand and Jeff Hilderbrand are the owners and developers of the project. PáTu's capacity is nine MW in total, consisting of six General Electric 1.5 MW turbines. The wind farm has created over 40 jobs during the construction phase and will hire approximately 15 part time employees during Operations and Maintenance phase. It is projected that the PáTu Wind Farm will pay $1.2 million in property taxes to the local government over the next 15 year period.

In 2001, the Hilderbrand family leased the wind rights of their land to a company called PPM Energy (the predecessor of Iberdrola, the world's leading provider of wind power), who wanted to develop wind energy projects Klondike I, Klondike II, and Klondike III in Sherman County [12]. After hundreds of megawatts of turbines were installed, the company decided not to develop a small portion of Hilderbrand's land in 2005 due to uncertainty of renewal of the Production Tax Credit (PTC) at that time. The Hilderbrand brothers grasped this opportunity, gained back the wind rights associated with the small piece of land, and

formed the Oregon Trail Wind Farm, LLC. With that, their long and rough journey of developing community wind had begun.

In early 2008, the Oregon Trail Wind Farm, LLC, and MMA Renewable Ventures (who would help find tax equity investors with a need for the PTC and also help put together the construction financing for the project) established a partnership and created the PáTu Wind Farm, LLC [2]. Their original plan was to take advantage of the PTC and use a "flip" structure for financing. In a "flip" model, PáTu needs to find a tax equity investor who provides the majority of the equity for building the project and receives the majority of the cash and tax benefits (i.e., the PTC) from the project. However, once the target internal rate of return has been achieved, which often occurs after the tenth year when the PTC is no longer available, the tax equity investor flips the major ownership of the project back to PáTu and let them receive the major benefits for the remainder of the project life.

Around July 2008, it was unclear whether the U.S. Congress would renew the PTC which was scheduled to expire on December 31 of that year. Therefore, many large wind developers such as Iberdrola pressed manufacturers very hard to get their turbines delivered as early as possible so that their projects could start generating power and qualify for the PTC before it expired. Unfortunately, small projects like PáTu would not be able to influence manufacturers and have their turbines delivered early enough to make the PTC deadline. Not knowing when the PTC would be extended, but knowing PáTu would not receive the PTC of 2008, one of the primary tax equity investors pulled out.

In the second half of 2008, the financial crisis broke. Although the PTC was eventually extended in October, potential tax equity investors who would provide money for the PTC from PáTu, such as Lehman Brothers, Wells Fargo and Bear Stearns, were wiped out by the crisis. Furthermore, the parent company of MMA Renewable Ventures (one component of PáTu), MMA, did not survive the financial hit, and thus sold the subsidiary to a Spanish company Fotowatio [31]. Since MMA Renewable Ventures specialized more in solar energy, and in fact PáTu was the first wind project that they were going to do, Fotowatio was more interested in their solar assets, not wind. The Oregon Trail Wind Farm, LLC, decided to buy the assets back from Fotowatio in early 2009, and abandoned the traditional "flip" structure for an innovative financing solution [19].

3.1.2. *Factors that lead to success*

Put aside the financing piece for a moment and look at other basic elements available that are necessary for the success of PáTu in the future.

- **Land availability:** Since the Hilderbrand family owned the land that the PáTu Wind Farm was going to sit on, the project did not have to worry about securing land.
- **Good wind resources:** The site had good wind resources, which was verified by the success of surrounding large wind projects such as Klondike and Biglow. PáTu obtained a two-year wind data collected by PPM Energy who eventually decided not to develop wind energy on the site. To analyze the data, PáTu hired an internationally known analyst so that banks will find the results more reliable.
- **Access to transmission line:** PáTu was fortunate to apply early for the transmission through Bonneville Power Administration (BPA) to sell power to Portland General Electric (PGE), because later the space on BPA's transmission was used up quickly. First, the power generated by PáTu comes out of the on-site substation and interconnects to the Wasco Electric Cooperative. From there, it goes to BPA's DeMoss Substation and then travels through BPA's transmission line to BPA's Big Eddy Substation in The Dalles. Next, it will be delivered to Troutdale Substation, which is the point of delivery for both PGE and PacifiCorp (See Fig. 1).

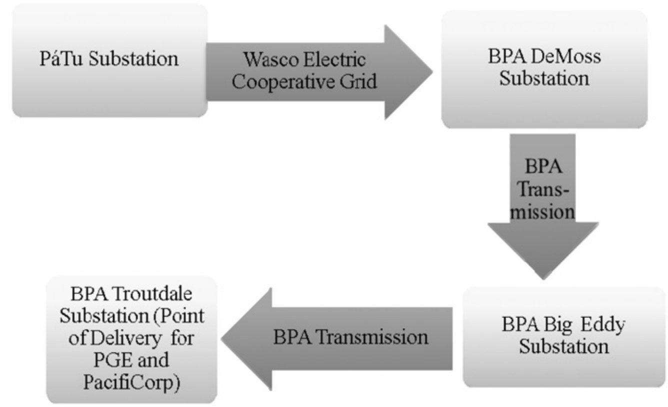


Fig. 1. Delivery path of PáTu power.

- **Power sale to PGE:** In 2005, the Oregon Public Utility Commission (OPUC) issued Order 05-584, requiring the three Investor-Owned Utilities (IOUs)-PacifiCorp, Portland General Electric (PGE), and Idaho Power-to provide standard rates and a Commission-approved 20-year standard contract for facilities up to 10 MW [25]. PáTu secured the power sale with PGE through this rule. The project developer commented on the significance of Order 05-584:

  > That's a huge deal, because I don't have to go out and find buyers. I know what my sales are going to be. I know what my wind resources are going to be. We have very reliable wind turbines with GE. So we can take a lot of risk out of the project.

- **Free of wildlife habitats:** Sherman County does not have significant wildlife habitats, and therefore there are few environmental concerns associated with energy development [3].
- **Social acceptance:** The county has been a home of many large wind energy projects, such as Klondike I, II, and III. Residents in the county are supportive of wind energy development. The project developer recalled the public hearing involved in PáTu's application for the Conditional Use Permit from the County:

  > The public hearing for our project was very easy. The county wants renewable energy. So our county has been very receptive to the development. Other counties are different. Here is much better. The land use permitting was approved in 2006. And the local residents are supportive of the project. The major benefit of project is taxes and employment.

- **Securing Oregon Business Energy Tax Credits (BETC):** Oregon BETC program provides 50% of the eligible project costs and is generally taken over five years at 10% per year [22]. The BETC also has a "pass-through" option that allows a project owner to transfer the tax credits to a pass-through partner in return for a lump-sum, discounted cash payment upon completion of the project [21]. PáTu received the pre-certification of the BETC in December 2006 and will use the Pass-Through option to build its financing structure. Although the state government later made substantial changes to the BETC, PáTu would not be affected for the reason that it had been pre-certified under the old rules.
- **Securing State Energy Loan Program (SELP):** PáTu also was approved for a $12 million loan from Oregon's SELP program, which provides long-term financing for renewable energy

projects by issuing bonds. PáTu is the first utility-scale wind project that receives SELP's loan [2].

- **Grant in lieu of Investment Tax Credit (ITC):** The immediate factor that allowed PáTu to give up the Production Tax Credits (which is prone to the instability of financial sector) and abandon the conventional "flip" structure was the passage of the American Recovery and Reinvestment Act of 2009 (ARRA) in February, 2009. The ARRA let wind energy projects eligible for the PTC receive either the 30% investment tax credit (ITC) or a 30% cash grant in lieu of the ITC from the Treasury Department. While the PTC is awarded based on the amount of electricity a project produces, the ITC and the grants do not have to do with the project performance but depend only on how much investors have invested into a project. With this, it will be much easier for PáTu to attract investors and finance itself. The project developer commented on the ARRA 2009:

  > The Congress passed the ARRA 2009 which enabled us to utilize the Investment Tax Credit instead of the Production Tax Credit. That was absolutely critical, because the ITC is based on how much you invest, not how much you produce. So it's much easier to find people who can value the investment tax credits. More importantly, they have what is called Grant in lieu of the ITC. It meant instead of me trying to find people who would purchase that tax credit, I can get a direct grant for the value of ITC directly from the U.S. Department of Treasury. That was a huge help.

- **Construction financing:** The government incentives that PáTu lined up (i.e., the BETC, the SELP, the ITC grants) for long-term finance, however, will not be available until the project is completed and operational. So the big piece PáTu lacked was construction financing. PáTu attempted to ask banks for a construction loan, but the efforts only ended up in frustration due to the size of the project. The project developer said:

  > I can show banks that I have a lot of pieces in place. But still people like California Banks, U.S. Banks, Wells Fargo, Bank of America…any bank I talked to, felt the project was too small for them. I wanted to borrow 20 million dollars for construction finance, and one person in U.S. Bank in Denver said we would like to work with you but you need to borrow at least 200 million. It's not worth our time and effort to do a 20 million dollar loan. Too small. Even though I had all the pieces back here after-construction finance, I still cannot have the construction finance.

  Fortunately, the Section 6108 in the 2008 Farm Bill created a critical opportunity for PáTu. The new rule authorizes the USDA to make loans for renewable energy projects that serve rural and non-rural residents. Traditionally, these kinds of loans targeted projects serving rural areas only, but with the modification, projects like PáTu who sell power to investor-owned utilities can qualify [30]. Therefore, PáTu received a construction loan from CoBank, a cooperative bank in the Farm Credit System, which typically lends to rural cooperatives. The project developer mentioned:

  > CoBank in the past could only lend to rural cooperatives, and they lent a lot of money to rural electrification cooperatives. Our small cooperative here, Wasco Electrical Cooperative, borrowed money from CoBank. Cobank also lends money for wind energy in the Midwest, so they understand renewable energy. But they couldn't loan to me directly, because I'm not a rural cooperative. When the U.S. Congress passed the Farm Bill in there with the provision, we went forward discussing with CoBank how to make all these pieces fit. In October 2009, we got a $16.5 million loan for the construction.

  Despite the $16.5 million from CoBank, to be able to construct this $22 million project, PáTu still needed to find another $5.5 million from other sources. The gap was eventually filled by two wealthy families willing to provide equity investment as well as a loan offered by the project developer. The Hilderbrand brothers will try to buy out the equity investors at the end of the fifth year of operations [2].

3.1.3. *Summarizing barriers and opportunities*

In 2001, the Hilderbrand family leased the wind rights of their land to a company called PPM Energy. In 2005, the company decided not to develop a small portion of Hilderbrand's land, and the landowners became interested in developing wind energy on their own so they established Oregon Trail Wind Farm, LLC. In 2006, the wind farm applied for the BETC and received preliminary certification of the tax credits in the December of the same year. In 2008, Oregon Trail Wind Farm partnered with MMA Renewable Ventures, and the partnership company is known as PáTu Wind Farm, LLC. Their original plan was to use the Production Tax Credit, but the financial crisis broke in late 2008, and MMA Renewable Ventures was sold to Fotowatio in March 2009. In addition, the tax equity investors that PáTu attempted to seek, such as Lehman Brothers, collapsed during the crisis. Fortunately, in February 2009, the Congress passed the ARRA 2009, which enabled PáTu to utilize of the Investment Tax Credit grant option instead of Production Tax Credit. In July 2009, CoBank was authorized to provide construction loans to renewable energy projects in rural America. In October of the same year, CoBank agreed to provide a 16.5-million construction loan to PáTu. Not long after, two families with investment capital offered a five-million equity, and the project developer also provided a small loan to the project. Since December 2010, the PáTu Wind Farm has been generating wind energy.

The biggest challenge for PáTu has come from financing. Difficulties associated with the PTC, disappearance of potential investors due to collapse of financial sector and changed ownership of the partner company MMA Renewable Ventures have all created tremendous barriers to this community wind project. Also, when PáTu decided to give up the "flip" structure and develop the project on its own, big banks were not interested in lending a construction loan to the project due to its small size (See Fig. 2).

However, on the other hand, there were opportunities that emerged in the course of building PáTu, which turned out to be definitely critical for the success the project. For example, passage of ARRA 2009 and the Section 6108 in the 2008 Farm Bill, as well as having two wealthy families as equity investors, provided timely and great relief to PáTu, for both long-term financing and short-term financing. In addition, being surrounded by other large wind energy projects gave PáTu substantial advantages. The developer said:

> I couldn't have done this project without the larger ones already being here. Even just the basic operations. The availability of large cranes to erect towers. The cranes that erect towers took 27 trucks to bring in here and cost more than one million dollars just to transport them and set it up. The cranes are already here because of the big projects. If I were the only one project here, it would not have happened. Also, I'm not qualified to maintain the equipment. I had to hire people to maintain that. The maintenance company is now based in here. They are French company that specializes in renewable

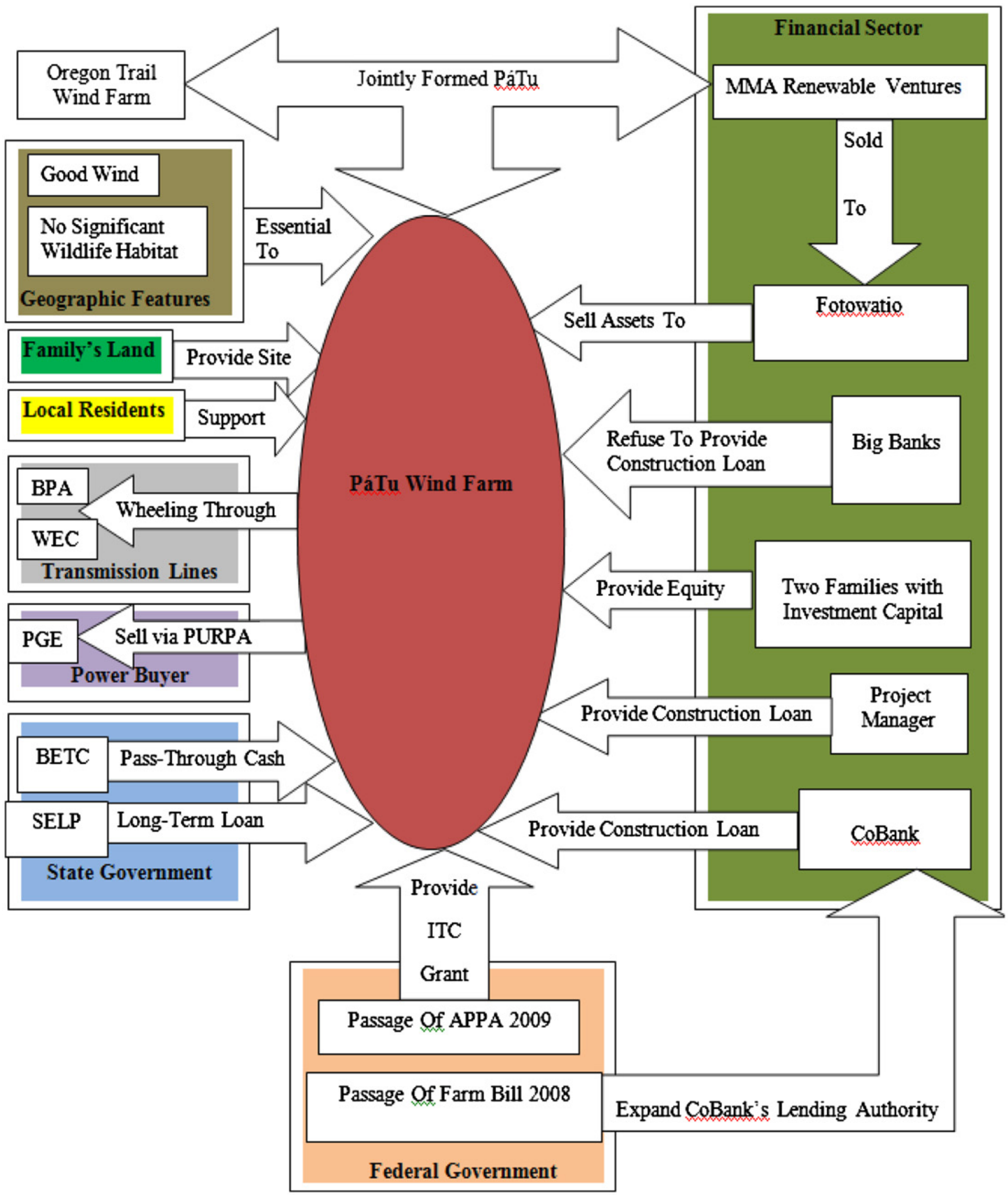


Fig. 2. Actor–network analysis of PáTu Wind Farm.

energy. So they have a basic operation here right now. They would not have been here without those larger projects being here. The bank would not have financed me if I could not maintain the equipment on a reliable basis.

3.2. *Case two: Sayrs Wind Farm*

3.2.1. *Project description*

A fourth-generation wheat farmer in Sherman County, Oregon, attempted to build a wind project called "Sayrs Wind Farm" on his family's farmland about three miles west of Moro. The plan was to have five turbines, with each being two MW in capacity. However, due to lack of the BETC in place, the project was not successful, and would be turned over to a large commercial developer by the time of this writing.

The wheat farmer's interest in wind development was originally inspired by a commercial wind developer who came to Sherman County wanting to secure properties for development of a large wind farm. The developer showed an example of wind project in Wyoming to the local land owners, and the wheat farmer found the idea fascinating, because he had hated the wind in the field and never thought it could be turned into something useful. However, instead of just leasing the land to commercial development, he decided to study the wind industry and build a project on his own.

3.2.2. *Factors involved in Sayrs Wind Farm*

When we analyze the Sayrs Wind Farm with the Actor–Network Theory framework, we identify some of the factors involved were similar to those in the PáTu Wind Farm in Case One. For example, both wind farms secured sites with good wind by using their family farmlands; both enjoyed the fact that Sherman County does not have significant wildlife habitat and that the local support was strong; both tried to sell power to PGE; both had similar financing structures in construction phase and

post-construction phase. The wheat farmer discussed about his construction financing experience:

> I was hoping to follow PáTu's lead. One of his equity participants was willing to be an equity participant in my project. Then the CoBank, which financed PáTu, was interested in doing more if our project was going to work. They'd be a prime candidate to jump into another project because they just went through it, and they understand how it should work. It should be a lot easier on the second project.

For the post-construction financing, Sayrs would use the ITC grant and probably a SELP loan to pay off the construction costs.

Sayrs also needed to use BPA's transmission line, which bordered the family's property, to wheel its power to PGE as PáTu did. But instead of approaching BPA to reserve capacity on the line on its behalf, Sayrs was able to use some of the capacity that the County has already reserved for community wind projects since 2007 (PáTu is not utilizing any of the reserved space for its reservation with BPA was earlier than the County's). The wheat farmer described the reservation made by the County:

> What happened was that when the big developer Iberdrola took power off of the BPA line and moved it into a different line, it left a hole in this line with some capacity there. Sherman County secured that 50 MW worth of capacity. The County reserved it for guys like me. Their intension was to make it available for community projects. Their vision was that we will have five separate ten MW projects utilizing that transmission.

Interestingly, although the general public in the county are supportive of wind energy development, very few are interested in participating in building wind projects by themselves. Therefore, the transmission reservation made by the County didn't stimulate the projects it hoped to see happening. The wheat farmer commented:

> The space is open to anybody who is interested in doing community wind. But we don't have a lot of people who are interested. The County has held it for community type of projects, and it costs them 70,000 dollars a year to hold this reservation from BPA. Now there were some commercial developers who would like to take it, so they had the discussions. The County said we'd like to see you provide the ability for these landowners to have some ownership somehow. There's a million different ways to structure the ownership, and we haven't finished that discussion yet.

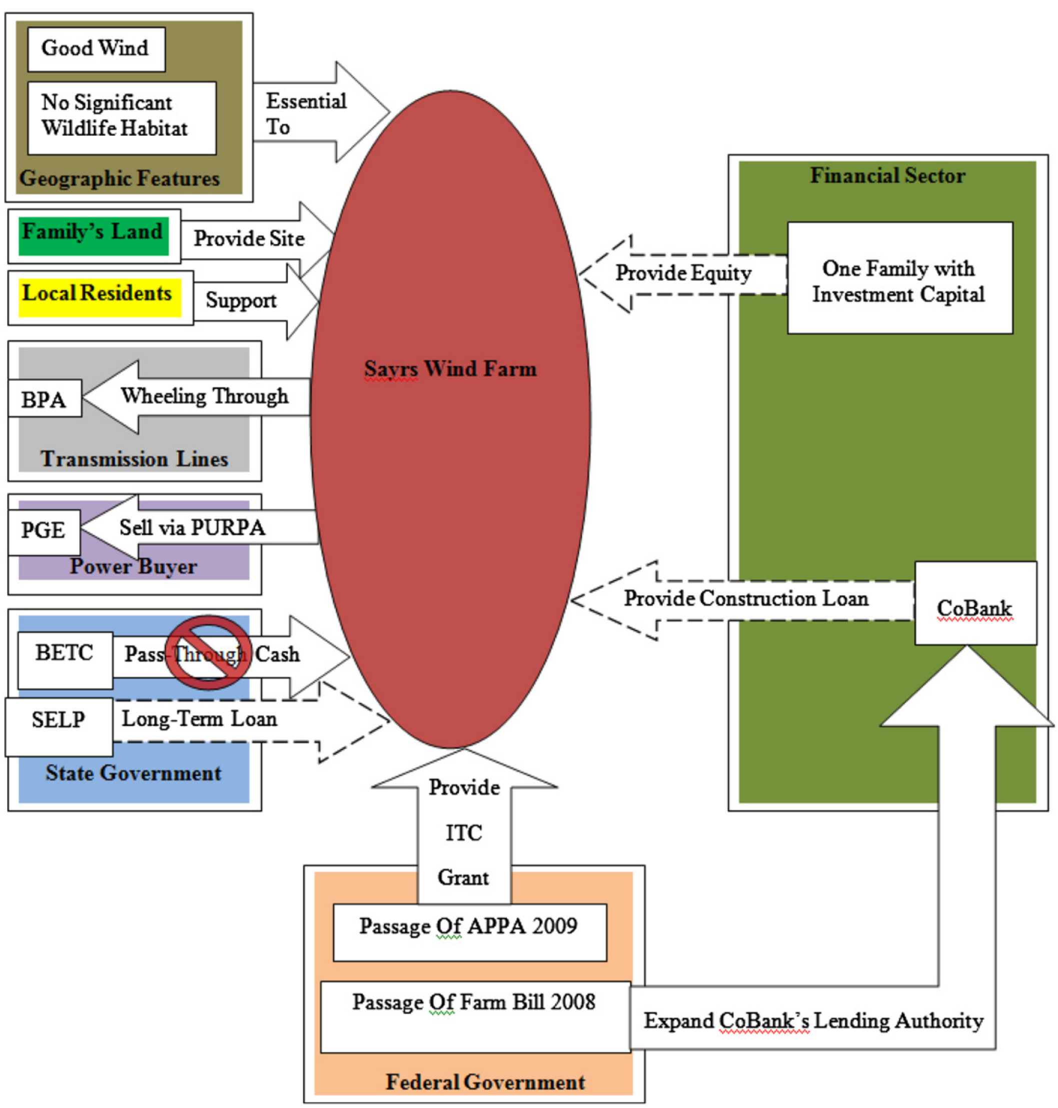


Fig. 3. Actor–network analysis of Sayrs Wind Farm.

3.2.3. Missing piece: The BETC

At first glance, Sayrs had almost exactly the same elements that PáTu did, but a closer scrutiny revealed a significant missing piece that eventually prevented the project from proceeding further: the Business Energy Tax Credits. The BETC were a given when PáTu applied for the tax credits, but by the time Sayrs applied for the incentive in 2009, the state government had started to change the rules of the BETC. The new rules make it much more difficult for community wind projects to receive the incentives. The wheat farmer commented on the BETC:

> I got rejected [on the BETC] a couple of months ago. Now the economics just doesn't work, because I cannot build it without the support of the BETC. With the five million dollar incentive, it would reduce the cost of the project from $25 million down to $20 million. At $20 million, I can make it work. But at $25 million, it won't. So the biggest hurdle on this project was the BETC. Next, I'm meeting with them [a large commercial developer] on Wednesday to firm up some of legal agreements basically to sell them the development, the Sayrs Wind Farm, I put together. There are some values in what I have here. I have the wind data, have access to transmission line, etc.

3.2.4. Summarizing barriers and opportunities

Sherman County reserved 50-MW capacity on BPA's transmission line in around 2006. The wheat farmer started planning for the Sayrs Wind Farm in August 2008. He applied for the BETC in 2009, and the incentive had been historically significant in promoting renewable energy including community wind in Oregon until the second half of 2009 when the program started to change from being a given to one with very limited budget. In 2010, the Oregon Legislature made official changes through HB 3680 to curtail the program. Major changes included setting tight sunset provisions, imposing caps on overall BETC awards, placing limits on wind facilities, requiring ODOE to develop a tier system to renewable energy facilities based on cost with a closer scrutiny of higher-cost facilities [8,29]. As anticipated, the Sayrs was rejected by the BETC program in 2010. As of the time of this writing, the wheat farmer was about to sell the development work of Sayrs to a large commercial developer.

Having a successful wind farm, PáTu Wind Farm, nearby provides valuable insights into how to develop a similar project in Sherman County. In addition, the local government's efforts of securing transmission capacity on BPA's lines were also considerably helpful. However, the missing piece of the BETC eventually stopped the Sayrs Wind Farm. Fig. 3 summarizes major factors involved in this case and their relationships.

3.3. Case three: Middle mountain wind project

3.3.1. Project description

Hood River County was exploring the possibility of building a nine MW wind project with six turbines on the Middle Mountain, a north–south trending ridgeline. However, due to strong local opposition, the County Commission decided to stop pursuing the project in May, 2010.

Faced with a decline in timber revenue from the County's 31,000-acre forestland (which provided nearly 44% of the general fund), an anticipated loss of federal timber payments, in addition to the state law on limitations of property tax collection, Hood River County attempted to increase the revenue by diversifying its economy [10,11,24]. Renewable energy development is one of the solutions identified, and the County has looked at small hydro, solar, biomass, and wind energy projects to date [10].

On the other hand, Hood River County is renowned for its natural beauty: some portions of the Columbia River Gorge

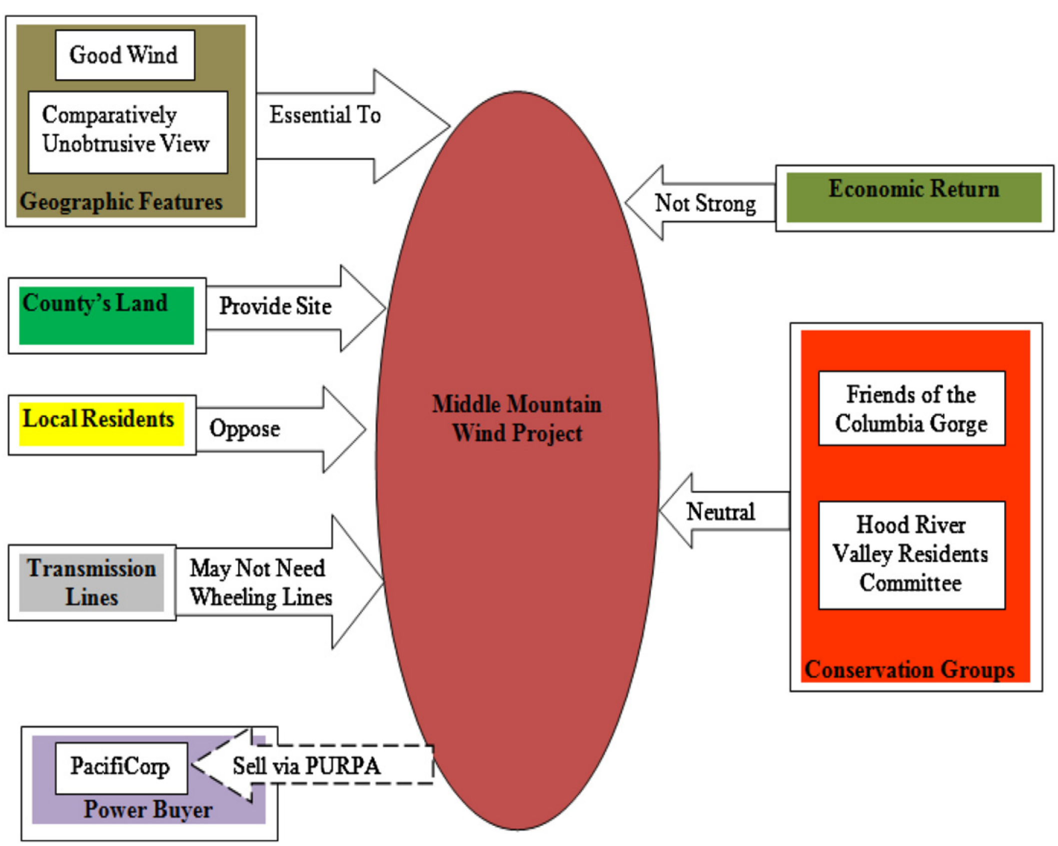


Fig. 4. Actor–network analysis of middle Mountain wind project.

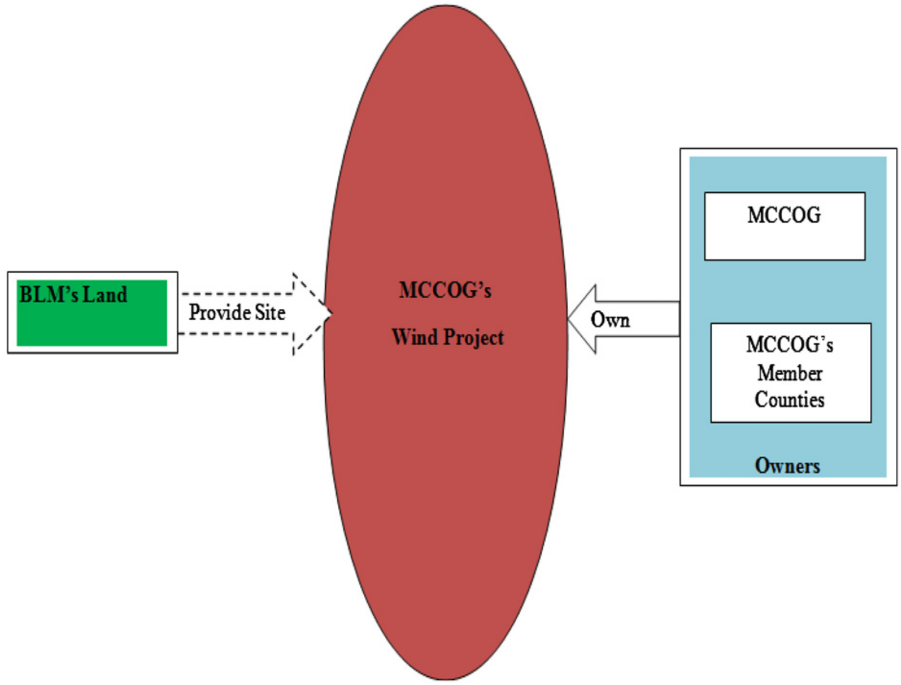


Fig. 5. Actor–network analysis of MCCOG's wind project.

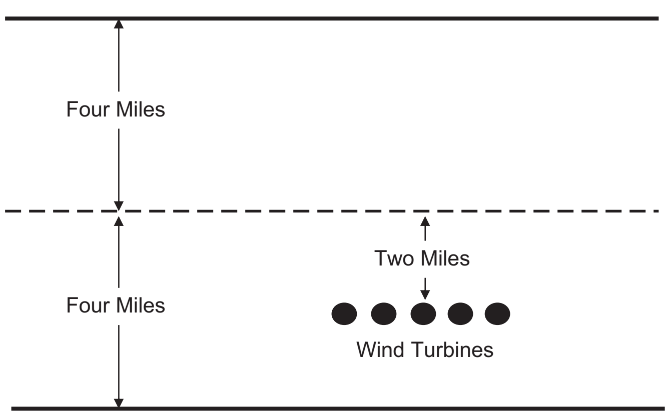


Fig. 6. Vertical view of the military training route.

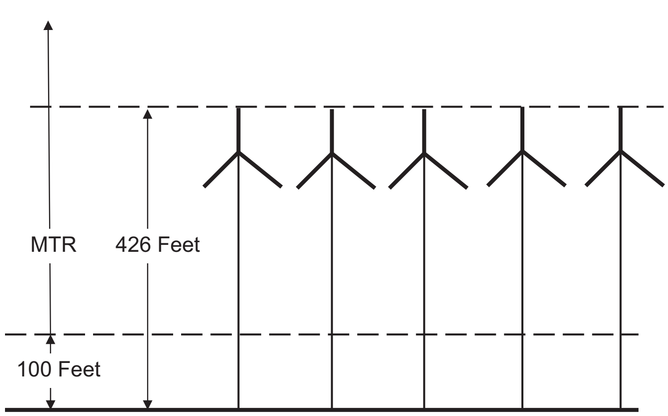


Fig. 7. Horizontal view of the military training route.

National Scenic Area are located in the county; Mount Hood, the tallest peak in Oregon, lies on the south border of the county; and over 14,000 acres of orchards in the county provide pears, apples, and cherries. Each year, the county attracts tourists from all over the world, and tourism now has been one of the principal sectors in local economy. Conceivably, having wind energy development in such a place would be extremely controversial because some people believe turbines are visually intrusive and are likely to affect tourism negatively. Others, however, believe that wind turbines can be an attraction.

3.3.2. Factors involved in the Middle Mountain project

The County has identified several potential wind sites for consideration, and one of them is the Middle Mountain. Major factors affecting the project are listed as follows:

- **Geographic features:** The project would sit on the ridgeline of the mountain, which is comparatively unobtrusive to the majority of the local residents in the county but with strong wind resources [32].
- **Land availability:** Hood River County owns the Middle Mountain area and did not have to worry about securing the land.
- **Power sale to PacifiCorp:** The project was planning to connect directly to its power purchaser PacifiCorp without going through other utilities' grid, so additional wheeling charges could be avoided [32].
- **Local opposition:** Before officially pursuing the project, the County organized several public meetings to present information and also to gather input from the local residents. Some people voiced their concerns about visual pollution and consequent impacts on tourism during the meetings. A County employee explained what he believed accounted for the local opposition:

  > There's always going to be some people that are opposed to whatever project you try to do in Hood River. One of the reasons is because Hood River is considered so scenic. We have this beautiful Mount Hood, which is considered the state treasure. All the people in Oregon consider it their mountain. They want to look at the mountain without seeing a bunch of wind towers in the horizon. In Hood River County you have to do things differently than in all other

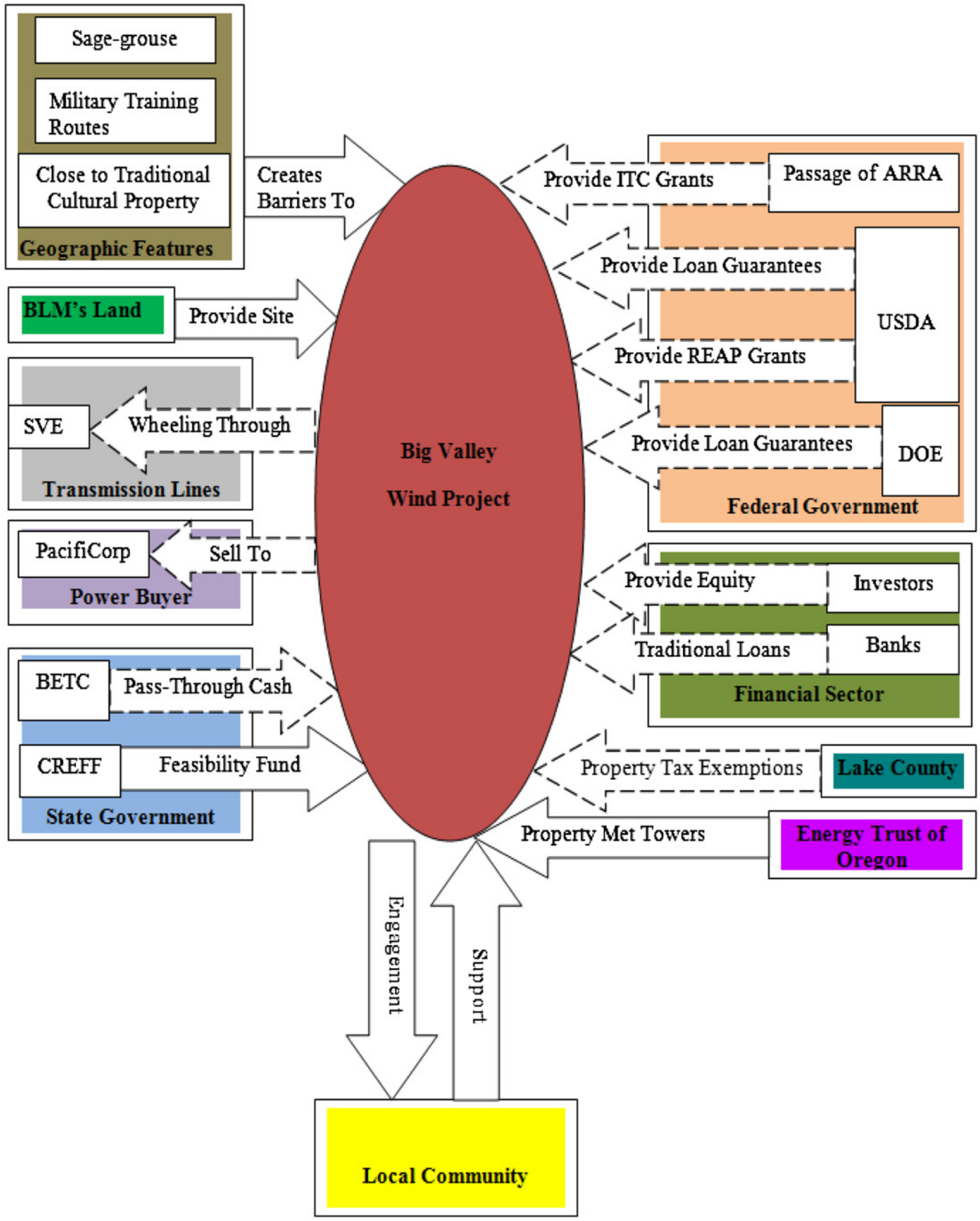


Fig. 8. Actor–network analysis of Big Valley wind project.

counties because we are scenic, and everyone desires to preserve our scenic values. That's why the commissioners took the time to go out to the people with all these little meetings and listen to the people.

[Another reason may be that] Hood River is probably too small. It's the second smallest county in Oregon. Most of the land in Hood River County is owned by the government [like] Forest Services. That doesn't leave a lot of land left over for private development. It's pretty closely zoned and regulated, and any place where you have smaller divisions of land, people are usually opposed to wind turbines, because the wind towers are close to populations. It's not like those eastern counties where people own 3000-acre ranch, you don't care if there's a few towers on your land. Farmers in Sherman County don't mind the wind mills. They can still raise wheat around the wind mill and they get paid the rent by leasing the land that the windmill sits on. So they can make maybe a couple of hundred thousand a year off leasing to a wind mill and make the money still off the wheat. So it's a good thing for them. That's why people are really in favor of it. But if you own only 5 acres or 40 acres [like us here], there isn't much benefit you can get from the wind. So you are not in favor of these big towers with a red light blinking on top of it.

- **Economic return:** An economic analysis of the Middle Mountain project indicated that the County would not receive

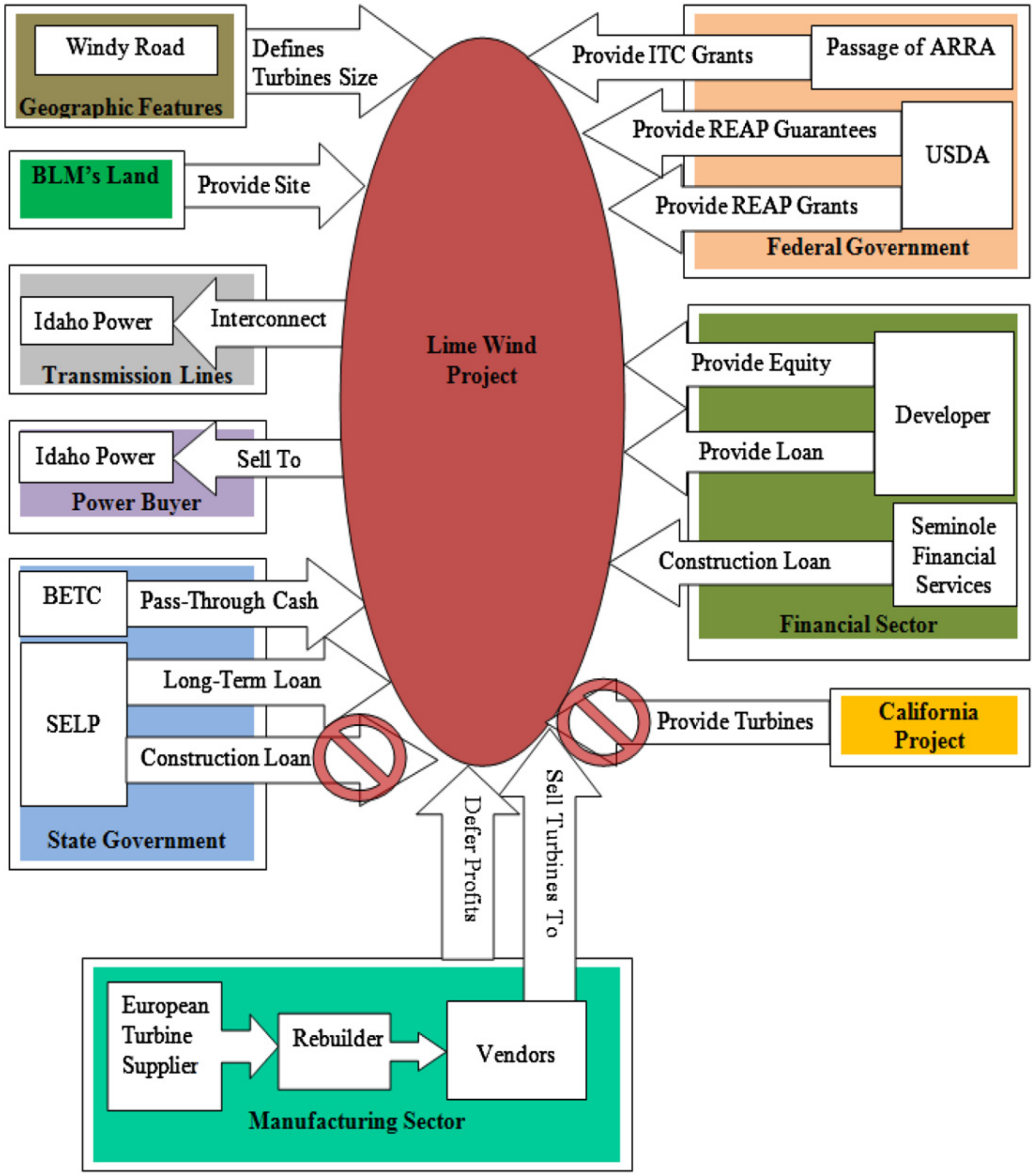


Fig. 9. Actor–network analysis of Lime Wind project.

significant economic gains until 2025, which eventually led the Commissioners to drop the plan [6]. The County employee commented:

> The County Commissioners felt that [if we were to] have something that affects our scenic [views], it had to be tremendous return on investment. As it turned out, there wasn't a significant return on the investment. There were too many unknowns. [For example], the BETC may be going away. And the community was pretty upset about it. So they canceled the project and essentially do not wish to allow any projects in Hood River County. Basically if somebody wanted a wind farm even a small one, say 10 MW, when they will apply for the Conditional Use Permit [from us], we will counsel them ahead of time that it would be very, very difficult for us to approve one.

- **Local conservation groups:** There are two local conservation groups, Friends of the Columbia Gorge and Hood River Valley Residents Committee (HRVRC), and both groups did not take a position on the project. Friends of the Columbia Gorge did not adopt a stance because the proposed project site-Middle Mountain-is outside of the Columbia River Gorge National Scenic Area (See Fig. 11) [7]. The HRVRC has two missions: first, protecting farm and forestland, and second, promoting livable communities in the Hood River Valley. Since the project contradicts the first mission but supports the second mission, overall, the organization decided to remain neutral.

3.3.3. *Summarizing barriers and opportunities*

The idea of the Middle Mountain project began in around 2005, when the Hood River County started considering development of renewable energy as a strategy to diversify the local economy. If successful, the County would have been the owner of the project, and the profits generated by the wind farm would have been revenue for the government. Therefore, the County had been very supportive of the Middle Mountain project, which was considered a major opportunity for the project. However, the economic return from the project was estimated to be lower than expected by a study in 2010. In the meantime, the general public voiced strong opposition against the wind farm in several public meetings. Given these two major considerations, the Hood River

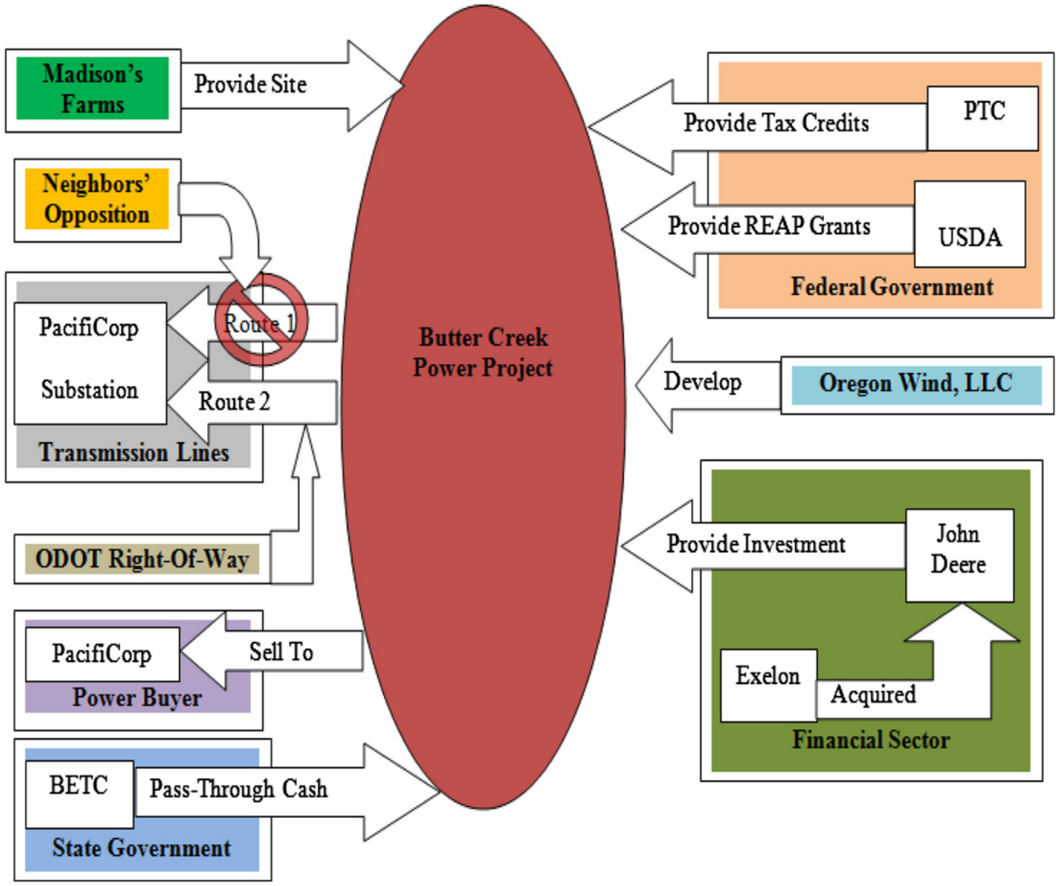


Fig. 10. Actor–network analysis of Butter Creek Power project.

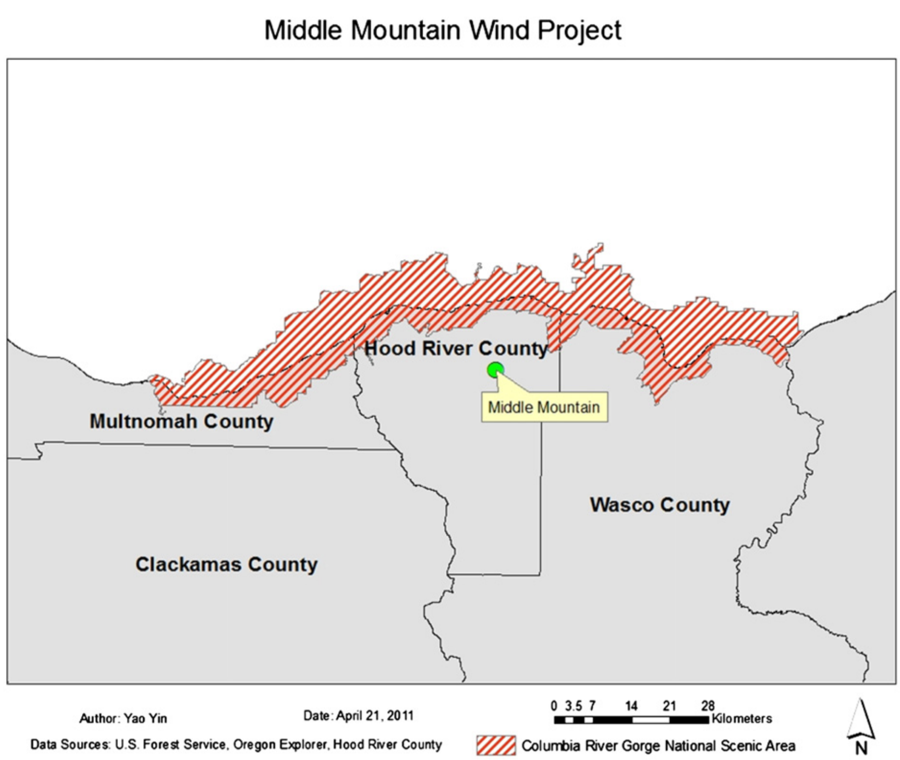


Fig. 11. Middle Mountain project Is outside of the Columbia River Gorge National Scenic Area.

County Commission unanimously decided to stop pursuing the project on May 17th, 2010. An important lesson of this case is that before anything, developers need to assure that there will be strong economic return from a wind energy project located in a scenic area; otherwise it is very likely that local residents would not allow such projects to happen at the expense of affecting scenic views (See Fig. 4).

3.4. Case four: MCCOG's wind project

3.4.1. Project description

Under the leadership of the Mid Columbia Council of Governments (MCCOG), several counties in the mid-Columbia region are seeking to cooperatively develop and own community wind projects on BLM land at Horn Butte in Gilliam County, Oregon or another site in the region. As of the time of this writing (early 2011), the project is in the early planning stage.

As a Council of Governments, the MCCOG is "an entity organized by units of local government under an intergovernmental agreement under ORS 190.003 to 190.130, which does not act under the direction and control of any single member government and does provide services directly to individuals" ([18]: 1). Originally, the MCCOG had three member governments when it was first created: Wasco County, Hood River County and Sherman County. In 1992, Gilliam County and Wheeler County joined the council, which expanded its services to the five-county region. One important purpose of the MCCOG is to promote intergovernmental cooperation for greater efficiency. Rather than each member government suffering from duplicate efforts, the council "consolidated five counties and streamlined the costs of running the programs operating under one entity-MCCOG" ([18]: 1). An MCCOG employee said:

> [The point is that] local governments can get together to form another organization that can do something cheaper than each individual organization does themselves.
>
> Another MCCOG employee described the entity's responsibility:
>
> We worked with these local governments in the five-county area in a variety of ways to support their efforts. We are an economic region and we are all in one together. If one of them is doing well, it helps all the rest.

3.4.2. Factors involved in MCCOG's wind project

Currently, the Council is working with its member counties to try to build a wind project on BLM's land at Horn Butte in Gilliam County or other more viable sites. The intent is to develop five to six projects below 10 MW size. Each project would be owned by a different government entity. Since it is still in the planning stage, there are many unknowns associated with how the final project will be built, but I'd like to share some factors identified below:

- **Project owners:** It is likely that the MCCOG will partner with its member counties to coordinate development of the wind projects. An MCCOG employee responsible for the project envisioned how the ownership structure may look like:

  > We've been looking at land in eastern Oregon for the last several years trying to find possible sites that might work out for six 10 MW projects, so maybe 60 MW in total. We'll build it 10 MW each. The hope would be that Sherman county would own one, the Hood River County would own one, Wasco County would own one, Gilliam County would own one…a piece of one or all of one. That was the kind of idea. We are trying to do something of coordinated efforts where more than one county can participate. But now it is still up in the air. We don't know if we can do six 10 MW projects, maybe two, or three, or four. If we find a site that will work for six projects, we may do six projects. If it's big enough for three projects, we may do three projects. [For the BLM's site at Horn Butte], we don't know exactly how big [a site we can permit] and how much wind it has. We haven't applied to the BLM yet. So there're still lots of questions and issues regarding what the ownership would look like. At this point we are not far enough to know what it will look like. We have a long way to go.

- **Land availability:** The Horn Butte area, owned by the BLM, is surrounded by private land where several wind energy projects have been developed (See Fig. 12). However, due to environmental concerns about the endangered species on the site, such as pygmy rabbits and curlews, the BLM would not let the developers build any wind projects there. The MCCOG employees were not optimistic about securing the land from the BLM:

  > All other big wind companies are on all sides of it [Horn Butte], but the BLM would not let them develop anything on the federal land. We thought we could maybe go talk to the government to get them to allow the County governments to have a project out there. We've even been talking about trading them some land and let them put the curlews on other land.
  >
  > We are still looking [for potential sites]. We thought this site would work, but we had difficulty getting BLM to agree that it's viable site. They are saying they are constrained with the environmental endangered species. So we'll see.

3.4.3. Summarizing barriers and opportunities

Due to the fact that the MCCOG's project is still in its early planning stage, many aspects have not been finalized as of the time of writing. However, the benefits it will probably have as a joint, intergovernmental effort is a wide range of support financially, economically, and administratively. The major barrier so far has been securing the Horn Butte site from the BLM, which contains habitats for the endangered species (See Fig. 5). Despite this, the project expected to start an application to BLM for permission to put meteorological towers up in early 2011 and monitor wind speeds for a year or two before they have enough information to

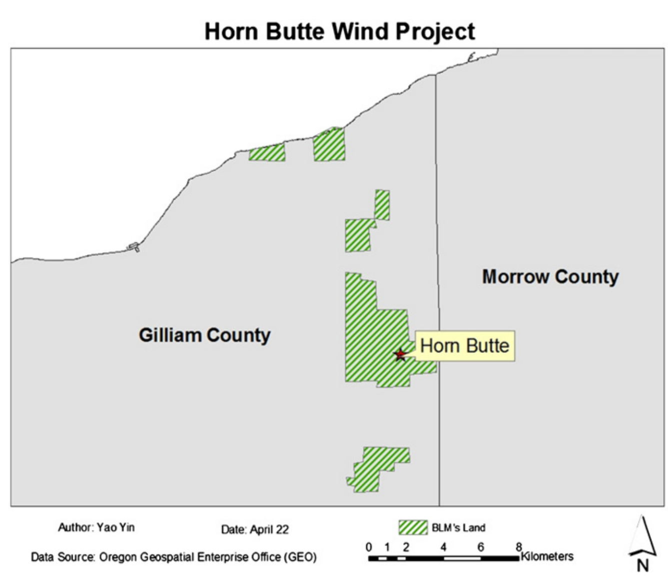


Fig. 12. Horn Butte wind project.

know whether it is feasible to build a project. In this case, the BLM district office did not seem to act very cooperatively to help develop wind energy projects, but in two other cases (Big Valley wind project and Lime Wind) the BLM was of great help. Therefore, it should be noted that the attitudes of federal agencies towards community wind energy can vary from district to district.

3.5. *Case five: Big Valley wind energy project*

3.5.1. *Project description*

The Oregon Community Wind (ORCWind), LLC, a community wind development company based in Portland, is planning to develop a 10 MW wind project consisting of five turbines on BLM land in Lake County, Oregon. The project has collected wind data using meteorological towers since June, 2010.

Established in March 2009, the ORCWind has been focused on small-scale community wind energy projects. The project developer introduced how the company started:

> There are four of us in total that are partners in the firm: myself, a finance person, and two wind siting engineers. After several years of talking about the different concepts, how we wanted to structure the business, we looked at several different options on types of projects we are going to develop. We came to the conclusion that community wind level was what we really wanted. So we established the firm in March 2009. We wanted to be able to bring wind power into small areas. Also we want to figure out a way to engage local people in the projects a little bit more.

Although the company is based in Portland and is not owned by community members from where their projects are located, I still consider their wind farms "community wind" because of four reasons: First, in terms of scale, the company target smaller-sized projects, typically less than 20 MW [20]. Second, their profits will stay in Oregon, and thus they are more "local" than other large commercial developers from outside the state or even outside the country. Third, the Big Valley wind energy project was awarded the Community Renewable Energy Feasibility Fund (CREFF) in 2010 from the Oregon Department of Energy as a qualified community renewable energy project [23]. Fourth, the company aims to utilize local resources and engage the local community as much as possible. The project developer said:

> We are going to source local contractors, local labor, and local resources. We look at different options to have the community to invest [into the project]. Also, if we establish a wind farm here, we'll give away scholarships to attend a credited program to become a wind turbine technician, a solar panel technician, a geothermal technician, and those kinds of things.

In order to find a suitable spot to develop community wind energy, ORCWind toured the state in January, 2009, and finally, they found a site on BLM's land in Lake County (See Fig. 13). Next, I will explore the major factors involved in this project.

3.5.2. *Factors involved in Big Valley wind energy project*

- **Meteorological towers:** The Big Valley project received its 50-m anemometer towers to collect wind data through the Energy Trust of Anemometer Loan Program. According to the requirements of the program, the wind data collected are shared with the public.
- **Community engagement:** The project started its community engagement very early by communicating with the Lake County Commissioners, having a Lakeview Town Council Meeting, cooperating with Sustainable Lake County Oregon and Lake County Resource Initiative, and meeting with the adjacent property owner and other local residents [28]. The project developer said:

> Before we put our met towers up, before we signed the lease [with the BLM], we went down, we started meeting people in the community. We first got introduced to the community through some renewable initiative group in Lake County called the Lake County Resources Initiative. These guys are trying to make Lake County the top renewable county in the state. [Then I was introduced] to the only adjacent private land owner for the project. He was very supportive of the project. We will need to cross his land [to construct the project], so we need to get an easement to come cross some of his land. Another thing is he has a rock quarry on his ranch. We are going to use his quarry to supply rocks for our roads, possibly rocks for portable or a batch of cement we establish for the foundation. We introduced our project to the County Commissioners, and we went to a Lakeview town hall meeting.

- **Local support:** After the close interactions and engagement, the project has gained considerable support from the local community. As the project developer stated:

> We got the letters of support from both of them [the Town and the County]. We have not found any opposition yet. They were very supportive of the project.

- **Land availability:** Securing the land from the BLM for site testing has been a tough journey for the Big Valley wind project. The first difficulty was the existence of habitats for sage-grouse on the BLM's land. Fortunately, the local BLM office was very helpful in guiding the project to avoid the environmentally sensitive areas. The project developer said:

> We worked hand in hand with their [the BLM's] biologists to identify an area that was suitable for us but also good for the sage-grouse so we could avoid sage-grouse upfront because it is a big issue in their district down there. They gave us information on the sage-grouse lichen site, the breeding ground. So we used that information to site. That was the biggest concern they have as far as wildlife impacts. We also checked in with their archeologists, botanists…their resource managers. We checked with all the resource

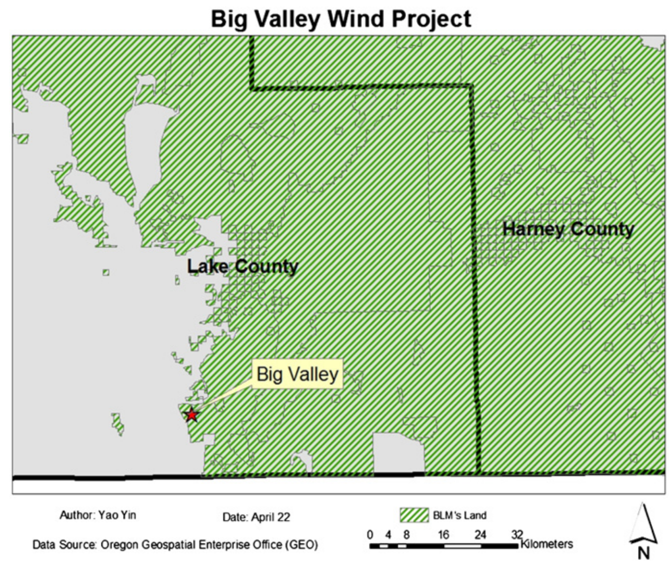


Fig. 13. Big Valley wind project.

managers to make sure the place we had was suitable, so down the road we wouldn't run into any problems.

Despite the lack of sage-grouse, the final selected site had an unexpected problem: it ended up in the military training route. In July 2008, to ensure compatibility of wind energy development with military activities, the Department of Defense (DOD) and the BLM developed a wind energy protocol, the purpose of which was to improve communication and coordination process between the two agencies in the review of proposed wind energy right-of-way (ROW) applications on the BLM's land [5]. Although the protocol established a process for the DOD to review and comment on proposed applications, the BLM has the ultimate responsibility to determine whether or not to grant the right-of-way. According to the comments of the DOD on the Big Valley wind project, the proposed wind turbines would be in the military training route (MTR) IR 300. Horizontally, the MTR is eight miles wide, and the project is parallel to and two miles off the centerline of the route (See Fig. 6). Vertically, the route has a 100-feet floor, which means the military can train down to 100 feet off the ground, and the highest point of the turbine blades are 426 feet above the ground (Fig. 7).

Nevertheless, in reality, the military training is not likely to take place in this designated route not only due to the complicated terrain but also because there is a 1000 kV DC line running through the route and the tower for the line is 125 feet high. The project developer said:

> They are not flying anywhere nearby. The Defense [Department] went back and looked at it again, and they came back with "No" again for the second time, and it went all the way to DC to the headquarters of the Department of Defense and the headquarters of BLM. So I was talking to a very high-level person of the BLM in DC. The BLM came back the December of last year and said the DOD agreed you can develop it as long as you [keep] as far from the centerline as you possibly can, which we [already] have because right next to us there's a huge canyon and we cannot move it over anymore. Plus we are stuck in this corner because there's sage-grouse all over the place. The thing is the BLM doesn't have to take the recommendations. It's not the DOD saying you cannot develop it. The DOD came back with the recommendations, and the BLM can ignore it, but generally they won't. So it went to DC, went to high levels, and there's some pressure from [the headquarters of] the BLM and DOD to say, look, this is a five-turbine project. The BLM has a goal to establish 10,000 MW on their land by 2015, and if you want a 10,000 MW, you cannot have this kind of [obstacles].
>
> We were originally supposed to install our met tower in June of 2009, and we were all ready to go with it, and this stuff came in. It was until the December 16 of 2009 for them to finally say yeah you can go ahead. But snow started, and you cannot put up a met tower until the snow is gone, and the land is drying out. You need to get your equipment out there. It took us to June 2010 to actually get luck because the snow was gone. So we were delayed for basically a year. Now we are collecting wind data.

In September 2010, however, another unexpected problem occurred to the Big Valley wind project. In order to properly design the wind turbine foundations and also to determine whether a transmission line can be buried underground, a geotechnical study will be required to collect data on soil, bedrock, groundwater, and other geotechnical conditions. In the meantime, the Fort Bidwell Indian Community in California filed a petition to the Ninth Circuit of the U.S. Court of Appeals for review over the BLM's approved right-of-way for the Ruby Pipeline, a natural gas pipeline project that runs from Wyoming to Oregon, because the Indian Community believed the BLM did not protect cultural resources adequately on the traditional cultural property [15]. So the BLM asked the Big Valley wind project to stop the geotechnical study due to its proximity to the area that the Indian Community was referring to. The wind project developer said:

> We had scheduled to do the geo-tech study in September this year. We had a contractor to come in, and they were going to take work samples at each one of the turbine locations. We were also looking at burying our transmission line. So we would go down transmission corridor and test it along the way to see what the soils look like, to see if we can bury a line. So we had all that lined up. And three days before we were supposed to start, a Native American Tribe, Ford Bidwell Tribe, wrote a letter to BLM saying they were going to take the BLM to the federal court and sue them over the Ruby Pipeline project. This project runs about eight miles from my project. This tribe felt they weren't properly consulted through the NEPA process. The NEPA process was already approved, but this tribe felt they weren't consulted. They were going to take the BLM to the federal court because this is what is called Traditional Cultural Property for the tribe. What that means is basically that land is used for traditional practices for hundreds of years by this tribe. However, they didn't give the defined area. The BLM got freaked out and said your wind project is near here. We have to stop your project, and we cannot let you do your geotechnical study.

Fortunately, the Big Valley project later found out that the Fort Bidwell Indian Community was more concerned with the valley area below the wind farm, not where the turbines will be located. Eventually, therefore, the BLM allowed the project to proceed with the geotechnical study. By the time they lined up with their equipment, however, wind had come and snow had started. At the time of the interview [December 2010], the geotechnical study was put on hold until the snow melts away.

- **Financing:** As mentioned earlier, the project received the Community Renewable Energy Feasibility Fund (CREFF) in 2010 from the Oregon Department of Energy to conduct suitability study. With respect to the construction, the project has not finalized its funding sources yet. The state government is likely to finance construction of small renewable projects in the near future, but it is up in the air at this moment. As far as the overall financing goes, the project is considering the BETC, ITC Grants, USDA REAP Grants, USDA Guaranteed Loans, U.S. Department of Energy Guaranteed Loans, property tax exemptions from the Lake County's Enterprise Zone Program, as well as private investment and traditional debt.
- **Transmissions and power sale:** The Big Valley wind project will need to build a segment of transmission line (overhead or underground depending on the results of the geotechnical study) to interconnect to the Surprise Valley Electrification Corp., the local non-profit rural electric cooperative. Then, the Surprise Valley will wheel the power to the PacifiCorp, the buyer of the power of the wind project.

3.5.3. *Summarizing barriers and opportunities*

Oregon Community Wind, LLC, identified the site on BLM land in February 2009, and intended to install the meteorological towers in June of the same year. But it was not until December 2009 that the Department of Defense finally agreed to let the project proceed. Then the snow started, and the installation was postponed until June 2010, when the snow was gone. So the

meteorological towers have started collecting data since then. In September 2010, the Fort Bidwell Indian Community in California filed a petition for review over the BLM's approved right-of-way for the Ruby Pipeline, which crossed their Traditional Cultural Property. Due to close proximity to the Ruby Pipeline, the Big Valley was stopped by the BLM. Several months later, the Big Valley found out that the Fort Bidwell Indian Community was not concerned with the wind farm, and project should be able to proceed. Unfortunately, in December 2010 winter season started again, and the Big Valley had to wait until snow melts.

As discussed in this case, environmental concerns for sage-grouse, existence of the military training routes, and proximity to traditional tribal cultural property have created enormous difficulty for the Big Valley wind project, which eventually resolved all these issues successfully. On the other hand, the Energy Trust of Oregon's Anemometer Loan Program and the state government's Community Renewable Energy Feasibility Fund have been helpful. Last but not least, local support is an important factor that made the project possible (See Fig. 8). An important experience from the Big Valley was that engaging with the local community in the early stage and getting local people involved in development would lead to increased acceptance of a project.

3.6. Case six: Lime Wind

3.6.1. Project description

Lime Wind is a three-MW wind farm, consisting of six refurnished 500-kW turbines, on the BLM's land near Lime in Baker County, Oregon. The project has been approved by the BLM and expects to start construction in July, 2011.

The owner (and also developer) of the Lime Wind is a wood worker and cattle rancher in Baker County. In 2004, he went to the Harvesting Clean Energy Conference in Portland and became intrigued by a new concept brought by the speakers: community wind. As the project owner described:

> I thought this is great. This is what we need. Rural economy, rural development. Use our resources to create income for rural communities and to have local ownership? That'll be fantastic. Maybe this is something I can do on my ranch.

With that in mind, he bought a meteorological tower and start testing wind on his ranch. Unfortunately, the wind did not seem to be promising for a wind farm. But that did not stop him. In 2005, the BLM issued the Wind Energy Programmatic Environmental Impact Statement (EIS) to assess the environmental, social, and economic impacts associated with wind energy development on BLM-administered land [4]. This inspired our developer to explore the possibility of building his wind project on the BLM's land.

After reading it [the Wind Energy Programmatic EIS], we thought oh we can do this on federal land. They were kind of soliciting companies to come and do that. So I got the wind maps out. We got the BLM map out. We put one over the other. Then we looked at where the transmission line was. We chose three sites, all on BLM's land. But we dropped one site because of sage-grouse. So we located two sites, very far apart, 40 miles apart. We tested it. Both of them have good wind. But this site had, from our perspectives, the best chance of being developed, because the other site is very visual. Actually Magpie Peak is right out there. You can see the turbines on a clear day. It was possibly a little bit controversial because of these aspects. (Fig. 14 at the end of the section shows the location of the project.).

Due to budget constraints and road conditions, Lime Wind decided from the very beginning to develop three MW capacity and use mid-sized refurnished turbines.

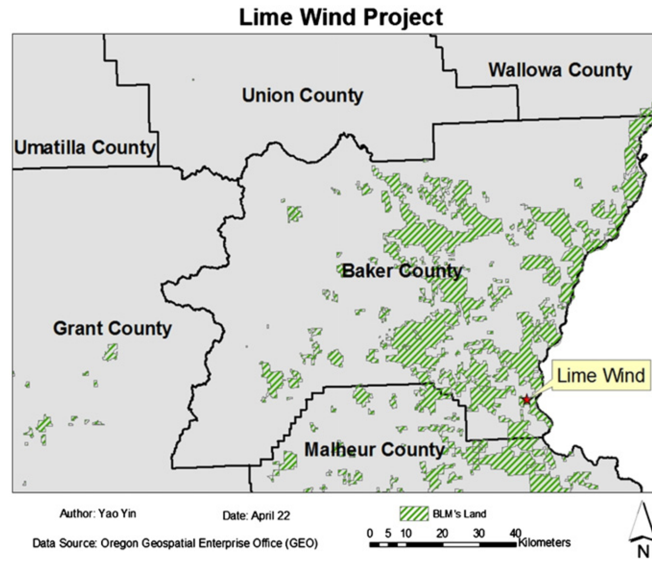


Fig. 14. Lime wind project.

> We figured we'll be three MW. That'll be two big turbines [if we use the large ones]. Access to this specific site is up a steep and windy road. It's very difficult to get large turbines up that hill. And my budget was not sufficient for new turbines, so budget and road require us to use refurnished mid-sized turbines.

However, securing mid-sized refurnished turbines was not easy nor was securing construction finance. I'll identify these major factors involved as well as other elements in much detail using actor–network theory in the next section.

3.6.2. Factors involved in Lime wind project

- **Securing turbines:** Originally, Lime Wind intended to buy mid-sized used turbines from a wind project in California, who was considering replacing the turbines with new, larger ones. However, it did not work out and those turbines never became available to Lime Wind. The project developer recalled the experience:

  > There were 600 of these Mitsubishi turbines down there in California. They were half the price of new turbines. I said oh, that sounds great. So I went down to California to look at the turbines. I meet this guy and I meet that guy. So we designed our project around using twelve 250 kW Mitsubishi turbines. But the turbines never became available out of California like they thought they would have. They thought they are going to take out the small turbines and put in new bigger ones because the site will end up with fewer turbines and more production. These guys suspected that they are going to take out 600 of them, and somebody is going to buy them, but none of that happened. By that time [around August 2009], I was pretty far down the road. I invested all my own money to that point, which became pretty substantial.

  Frightened of not being able to secure turbines, the developer started looking for turbine suppliers again. Through luck and perseverance, he eventually found some turbines in Europe that fit the budget and size requirements.

  > When we were talking about substituting other turbines, I went home and really freaked out. So I went on the internet, and I started looking at every turbine that's out

there. Anything I could find. I really started looking much deeper into how the turbines work. I didn't pay much attention before. But now we were through the Environmental Assessment [with the BLM], and received the REAP grant, and we've done all that paper work. I sent out hundreds of emails across the globe and started filtering the responses. [Finally,] I found some turbines in Europe that looked like they would work. I went to Europe last December [December 2009], located the turbines, and made the deal.

- **Securing construction financing:** Another big hurtle that Lime Wind needed to overcome was to find ways to finance its construction. Lime Wind did not want to bring in equity investors, and therefore was focused on construction loans. The project developer commented:

  We looked at the ownership, [and decided to go with the loans], not because we want to own it, but because we were reluctant to bring anybody else's money into something that we really didn't know what the outcome was.

  Therefore, the project applied for a construction loan from the Oregon Department of Energy's State Energy Loan Program (SELP), which was designed to provide both short-term construction loan and long-term loan at that time. Suddenly, the financial sector collapsed, and the state government decided to eliminate the short-term loan for construction from the SELP program.

  Originally, I had a construction loan and a long-term loan from the ODOE, because you cannot find construction financing with these projects. [It's] very, very difficult, especially with the conventional lenders. Then, the loan officer pretty much told [me] they could not do any more construction projects. I was one of them who got cut off. Ever since, the SELP no longer does construction loans.

  After contacting over 100 institutions and investors during a one-year continuous search for a construction lender, Lime Wind finally found one-Seminole Financial Services-who would provide loans to cover the majority of the seven-million dollar total costs. In addition, the developer himself will provide 0.6 million dollars in forms of equity and personal loans to the project. Also, the turbine supplier, the rebuilders, and the vendors will defer their profits without lien on the project until it is completed and post-construction funds become available, which is a substantial help to Lime Wind.
- **Other incentives:** Other incentives the project will receive include the ITC Grant authorized by the ARRA 2009, the REAP Grant from the USDA, the BETC and a long-term SELP loan (guaranteed by the REAP program) from the Oregon Department of Energy.
- **Transmission and power sale:** The power generated by Lime Wind will interconnect to Idaho Power's grid and sell the power to Idaho Power as well. Currently, the existing distribution line and substation will need to be upgraded to carry the three-MW capacity.
- **BLM's land:** The local BLM office has guided Lime Wind through the NEPA process with patience and fairness. The project went through the Environmental Assessment option rather than the Environmental Impact Statement because of its small scale and impact.

3.6.3. Summarizing barriers and opportunities

The developer and owner of Lime Wind became interested in community wind energy in 2004. Originally, he intended to build a wind energy project on his own ranch, but the wind resources were not adequate enough. In 2005, the BLM issued the Wind Energy Programmatic Environmental Impact Statement (EIS), which inspired our developer to explore the possibility of building a wind project on the BLM land. In 2006, he decided to build this Lime wind project on BLM land in Baker County. Due to budget constraints and road conditions, the project needed to use mid-sized refurnished turbines. He expected to buy used turbines from California, but unfortunately those turbines never became available. In September 2009, the developer realized that he would have to substitute turbines from other sources, and started looking intensively for refurnished turbines. In December 2009, the developer went to the Europe and found the type of turbines he needed. By the time he came back from Europe, the Oregon Department of Energy's SELP had stopped providing construction loans, which created another barrier to Lime Wind. After one-year continuous search for a construction lender, the developer finally found one-Seminole Financial Services-who would provide construction loans.

Securing refurnished turbines is not a common situation for community wind, but it fits Lime Wind's budget and road conditions. Although finding out a construction lender is a major barrier that the project has experienced the developer's perseverance led to the resolution of theobstacle. In the meantime, the government incentives, manufacturers' contributions, as well as the BLM's guidance were significantly important for the success of the project (See Fig. 9).

3.7. Case seven: Butter Creek Power, LLC

3.7.1. Project description

The Echo Wind Farms, located in Umatilla County and Morrow County, consist of nine wind projects with a total capacity of 64.5 MW [13]. Three of the projects involve local ownership and are considered community wind projects by this dissertation's definition. My research is focused on the Butter Creek Power, LLC, one of the three community projects, which has been operational since October, 2009.

Several years ago, a wind energy development company Oregon Wind, LLC approached the Mader–Rust family and their neighbors, the Madison family, to explore the possibility of building wind projects on both families' farmland. The local landowners liked the idea of generating clean power from wind and in the meantime creating extra revenues in ways that do not affect farming. In order to best utilize government incentives for community wind such as the PURPA, the developer designed nine projects on the two farmlands with each one no more than 10 MW. With this nine-project package, Oregon Wind searched for interested investment partners who would bring equity to build the cluster of projects. Eventually, the developer secured a partnership with John Deere Renewables which had a need for the Production Tax Credits (PTC) associated with renewable energy generation. Typically, the tax equity investor provides the majority of the equity for building the project, and receives the majority of the cash and tax benefits out of the project. As noted earlier, once the target internal rate of return has been achieved, which generally occurs after the tenth year when the PTC is no longer available, the tax equity investor flips the major ownership of the project back to the local investors and let them receive the major benefits for the remainder of the project life. The turbine arrangements of the Echo Wind Farms are shown below in Tables 1 and 2 [26].

The whole Echo Wind Farms consist of 271.65 MW turbines and 10.2 MW turbines, for a total capacity of 64.5 MW on Mader–Rust Farms and Madison Farms. Each project is an individual, legal LLC entity with no more than 10 MW in order to qualify for the PURPA. PacifiCorp is the buyer of the power generated. Except

Table 1
Wind turbines on Mader–Rust farms.

On Mader–Rust farms	Owners	Turbines (MW)	Capacity (MW)
Big top	Landowners and John Deere	1 × 1.65	1.65
Wagon Trail	Landowners and John Deere	2 × 1.65	3.3
Pacific Canyon Windfarm	A Group of individuals and John Deere	5 × 1.65	8.25
Sand Ranch Windfarm	Oregon Wind and John Deere	6 × 1.65	9.9
Four Mile Canyon Windfarm	John Deere	5 × 2	10

Table 2
Wind turbines on Madison's farm.

On Madison's Farms	Owners	Turbines (MW)	Capacity (MW)
Butter Creek power	Landowners and John Deere	3 × 1.65	4.95
Ward Butte Windfarm	Same group of individuals as in pacific Canyon Windfarm and John Deere	4 × 1.65	6.6
Oregon Trail Windfarm	Oregon Wind and John Deere	6 × 1.65	9.9
Four Corners Windfarm	John Deere	5 × 2	10

for the Four Mile Canyon Windfarm and Four Corners Windfarm which are solely owned by John Deere, all the projects have a partnership between John Deere and other investors. Big Top, Wagon Trail, and Butter Creek Power involve local ownership and are considered community wind projects according to this dissertation's definition. I interviewed the landowner of Madison's Farm who is also the owner (with John Deere) and manager of Butter Creek Power, LLC. He described how the "flip" and "management" worked for the project:

> We all have the partnership with John Deere. John Deere owns 99% [of the project], and we own 1% of it. After John Deere makes a certain return on their investment at an internal rate on their investment, then we flip positions. At that point, we will own 95% and John Deere will own 5%. That'll happen in about 12 years supposedly depending on how good the wind blows and that kind of stuff. [However], we own 51% of the management control, and John Deere owns [49% of it]. Basically, John Deere came in and said I'm going to build it and have the tax credits for it. I'm going to get an internal rate of return on my investment. In exchange, I'll let you manage it. The better you can manage it, the better I can make it productive, the more profits it makes each year. So the more productive we are as managers, the sooner John Deere makes their rate of return and at that point of time they flip it over to us.

In 2010, Exelon Corporation acquired John Deere Renewables' wind energy assets and thus became the investment partners in the Echo Wind Farms in lieu of John Deere [9]. Therefore, the Butter Creek Power will have its flip between the manager and Exelon.

3.7.2. *Factors involved in the Butter Creek Power project*

- **Government incentives:** There were several government incentives to make this project happen, such as the PTC, the REAP grant, and the BETC. Among all, the BETC was the most difficult one to get due to the fact that the state government did not expect a cluster of wind projects to happen like the Echo Wind Farms. That is, they were not sure if the Echo Wind Farms should be treated as one project or multiple projects for the purpose of BETC.
  In the very beginning, the developers made sure in the arrangements of the wind turbines that projects owned by the same owners were five miles apart from each other so that they would not be deemed to be a single project by BETC's standards back then. Therefore, each project of the Echo Wind Farms planned to claim its own BETC credits independently. The manager recalled his experience with BETC:

  > Because we are each individual legal entities, we claim our own BETC. We played by the rules there were by the time. We built the project by the rules Oregon had on the book by the time. But the BETC people weren't happy because no one had ever done this before. They never thought about it. But we thought about it, and we did it because that's what the rule said. But they said we cannot let you do that, because you guys are too close together. Yours and these guys' [projects] kind of line up, and we are going to call that one project. We said wait a minute. It's like if I park my car in the street, and a neighbor parks his car in front of my car. Just because we are lined up, it doesn't mean the neighbor owns my car. They just both happened to park in the same street. They feel a pain about it.

  Eventually, the Echo Wind Farms did not receive as much credit as expected because the state government decided to change the way that BETC had worked and to apply the new rule to the wind farms. The manager continued:

  > They didn't give us as much as the law says they should at the time. They said we are going to change the law, and they were going to make it retroactive before our projects. We said wait a second, we financed it, and we did everything based on Oregon's rules at the time. They said tough luck. That's just the way it is. So they changed the rules.

  The reason the state government was able to change the rule and make it retroactive was that the Echo Wind Farms by that time had not been issued a final certificate and thus were still in the application phase. If the wind farms had been issued a final certificate, the state government could not have changed the rule to work against them.
- **Transmission lines:** Each project of the Echo Wind Farms owns a certain percentage of the substation and the transmission line depending on their percentage of total power capacity each accounts for. For Butter Creek Power, the manager explained:

  > The transmission line and the substation are ours. We built them, we own them, and we maintain them. I own roughly 7.7%, [because] I own 4.95 MW and if you divide it by 64.5 MW, it is 7.7% would be my share. It [the transmission line] goes down [along] Highway 207, and connects to a PacifiCorp substation at Hinkle.

  The route of the transmission line was a bit controversial. Originally, the line was planned to cross some private

properties owned by the neighbors. However, the neighbors did not like to see the power poles in their backyard and thus opposed the route. Eventually, the line had to use a different route which exhausted the Oregon Department of Transportation's public Right-Of-Way for Highway 207 in the area. A local government employee recalled:

> They [the Echo Wind Farms] filed for a Land Use Decision (LUD) application for the transmission line. That decision was appealed by the neighbors, and the Board of Commissioners ultimately approved the appeal. That second line used up the balance of the State's Right-Of-Way.
>
> The Echo Wind Farms attempted to pay a neighbor $75,000, which was seven times more than what a utility would normally pay, for putting the transmission line along the edge of her property with the power poles being one-foot inside the property. The neighbor rejected the offer, and left the wind farms with no options other than using the public Right-Of-Way. Ironically, one of the power poles under the Right-Of-Way was placed right in front of her house. The manager said:
>
> It would be a lot simpler to go the original way, because the State's easement was crooked, and the public Right-Of-Way was longer and more expensive. We would like to offer the neighbor $75,000, but now they did not get a piece of pie. We took the last space on that Right-Of-Way, so nobody else in the future can do anything, because we used it. A good foresight would have been that let's allow you to build this project by using as much private property as we can, and save that public corridor for somebody else that doesn't have the ability. So basically we used the public resources we didn't need to.

3.7.3. Summarizing barriers and opportunities

Several years ago, Oregon Wind, LLC, approached the Mader–Rust family and the Madison family to explore the possibility of building wind projects on both families' farmland. With the permission from both families, the developer started searching for equity investors and eventually secured a partnership with John Deere Renewables. The whole Echo Wind Farms was approved for a transmission line route in 2008. However, some neighbors appealed against County Planning Commission's approval for the transmission route. In the end, the project had to use ODOT's public Right-Of-Way for Highway 207 to build the transmission line. The Echo Wind Farms started generating electricity in 2009. Exelon Corporation acquired John Deere Renewables' wind energy assets and thus became the investment partners in the Echo Wind Farms in 2010.

Having professional developers (Oregon Wind, LLC) develop the project and secure investment partners was key to the success of Butter Creek Power. Plus, government incentives also helped the project considerably, and availability of the public Right-Of-Way made the transmission possible. However, the State's change of how BETC should be applied and lack of local support for the original transmission route created substantial barriers to the project (See Fig. 10).

4. Discussion

As demonstrated in the seven case studies, the actor–network theory is a useful tool to analyze wind energy projects from multiple perspectives, such as the material aspects of wind technology, the geographic characteristics of the location, the community's attitudes towards the facilities, as well as the political climate in which they are embedded [14]. Combining the technical dimensions and the social dimensions, the approach provides a holistic snapshot of major factors involved and relationships between them. Applying this theory to the seven empirical cases in Oregon has helped our understanding of the natural–technical–financial–political environment for community wind energy projects.

Based upon the results, common factors that emerged include geographic features, land ownership, attitudes of the local residents, wheeling utilities, power buyer, county incentives, state incentives, federal incentives, other incentives, financing sources, developers, conservation groups, and manufacturers. Table 3 summarizes examples from the seven cases for each major factor. Geographically, project developers or owners should pay enough attention not only to the wind resources, but also whether there are wildlife habitats, scenic landscapes, military training routes, or traditional cultural properties nearby. In terms of land ownership, community wind energy often takes place on farmland, BLM's land, and county government's land. Socially, local residents may support or oppose wind energy in general or only form an opinion about the location of the project or transmission lines. To deliver the power to the buyer, wheeling utilities might be involved and a fee will be charged for using their transmission lines. Under the PURPA law, investor-owned utilities, which in Oregon include PacifiCorp, PGE, and Idaho Power, are required to purchase renewable energy no more than 10 MW. Some counties have the enterprise zone programs where businesses will be exempt from property taxes. At the state level, BETC, SELP, and CREFF have been substantially helpful for community wind energy development. At the federal level, most often used incentives include the PTC, ITC Grant, USDA's Loan Guarantees,

Table 3
Common factors emerged from seven cases.

Common factors	Examples from Case Studies
Geographic features	Wind resources; Presence of Wildlife Habitats; Presence of Scenic Landscape; Presence of military training routes; Proximity to Traditional Cultural Property
Land ownership	Family's Farmland; BLM's Land; County's Land
Local attitudes	Support or oppose wind energy; suppose or oppose Location of Facilities
Wheeling utilities	BPA; Wasco electric cooperative; surprise Valley electrification Corp; Build their own transmission lines
Power buyer	PacifiCorp; PGE; Idaho Power
County incentives	Lake county's property Tax exemptions
State incentives	BETC; SELP; CREFF
Federal incentives	PTC; ITC Grant; USDA loan guarantees; REAP Grant; REAP loan guarantees; DOE's loan guarantees
Other incentives	Energy trust of Oregon's Anemometer Loan program
Financing sources	Companies; wealthy families; Banks; Personal investment
Manufacturers	Turbine suppliers; turbine rebuilders; vendors
Developers	Outside professional developers; landowners themselves
Conservation groups	Friends of the Columbia Gorge; Hood River Valley residents committee

REAP Grant, REAP Loan Guarantees, and DOE's Loan Guarantees. In addition, the Energy Trust of Oregon has an Anemometer Loan Program to help finance meteorological towers. Financing sources for the whole project can come from companies, banks, wealthy families, and even personal investment. With regard to manufacturing, there are both new turbine suppliers and used turbine suppliers in the sector, and the used turbine suppliers often work with rebuilders and vendors to sell their turbines. For community wind energy, developers can be outside professional developers; they can also be landowners themselves. Last but not least, conservation groups may support, oppose or stay neutral on wind energy, depending on its interests, primary missions, and factors in that nature. Identifying these factors can advance understanding of different views on the wind project and predict the outcome of projects that have similarities with the case studies. Essentially, the actor–network theory has answered three questions for us: who is involved? What interests are represented? How do these interests interact? [14].

In order to identify the similarities and differences of the seven projects, the author compared and contrasted the cases in terms of project size, land ownership, results, major opportunities and major barriers. It showed that they are similar in size (i.e., they are all no more than 10 MW to be able to meet the PURPA requirements). The lands the projects were built on have different ownership: private farmland, county's land, or federal land. The results were different: some have been up and running, some may be stopped, while others may still be in development or about to start construction. Also, the major opportunities and barriers they each experienced can be time-specific and/or location-specific. For example, the financial market and policy institutions change over time, and depending on the time point a project starts, the wind farm may face a very different set of financial and policy opportunities and barriers. Location-wise, the existence of military training route or proximity to scenic areas should be noted in planning the development. It is suggested by the results that a developer needs to pay attention to both temporal and spatial factors in planning a wind farm. A summary of project attributes and major factors is presented at the end of this section (See Table 4).

Utilities often enter into a contract with large-scale renewable energy projects to fulfill their obligations of Renewable Portfolio Standards (RPS), and their electricity price is reached through negotiation. Therefore, the success of the contract typically depends on how well utilities are meeting their RPS goals and the prices of fossil fuels. Community-scale renewable projects under 10 MW, however, are guaranteed to have a market because of the PURPA law regardless of other factors, but the electricity price is based upon the avoided cost, which is affected by the prices of fossil fuel. In terms of transmission, most of the community wind projects take advantage of existing grids because building new lines would incur a particularly heavy financial burden on a small project. However, if several small projects can be bundled up into a package, like what we see in the Butter Creek, it is worthwhile to pay to build new lines on their own and bring more power online.

Last but not least, the Actor–Network Theory (ANT) analysis is a powerful instrument to describe actors involved in a socio-technological process and to illustrate how they interact with each other, and ultimately these analyses can be compared and contrasted among each other to identify similar patterns and distinguishing characteristics.

Table 4
Important attributes and major barriers and opportunities.

Project names	Project size	Land ownership	Major barriers	Major opportunities	Results
PāTu	6×1.5 MW=9 MW	Private farmland in Sherman County	Collapse of financial Sector	Availability of ITC Grant; construction Loan from CoBank; Investment from Two Families; Surrounded by Other Large wind projects	Successful, operational since December 2010
Sayrs	5×2 MW=10 MW	Private farmland in Sherman County	Did not receive BETC	Having PāTu as an example; local Government securing transmission capacity for community wind projects	Not likely to succeed as of early 2011
Middle Mountain	6×1.5 MW=9 MW	County's Land in Hood River County	Presence of scenic landscape; strong public opposition	County Government's Support	Failed in 2010
MCCOG's project	To Be Decidedbut Should Be <10 MW	BLM Land in Gilliam County	Presence of endangered Species on BLM's Land	Member Governments' Support	Early-stage of development, future unknown as of early 2011
Big Valley	5×2 MW=10 MW	BLM Land in Lake County	Presence of endangered Species on BLM's Land; Presence of military training routes; proximity to traditional cultural property	Local support; energy trust of Oregon's anemometer Loan; CREFF Fund	Mid-stage of development, very likely to succeed as of early 2011
Lime	6×500 kW=3 MW	BLM Land in Baker County	Securing mid-sized refurnished turbines; securing construction financing	BLM's Guidance; BETC; SELP; ITC Grant; REAP Grant; REAP loan guarantees; Manufacturers' Contributions	Successful, construction starts in July 2011
Butter Creek Power	3×1.65 MW=4.95 MW	Private farmland in Umatilla County	Changes of BETC; local opposition for original transmission route	Having professional developers; investment from John Deere	Successful, operational since October 2009

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